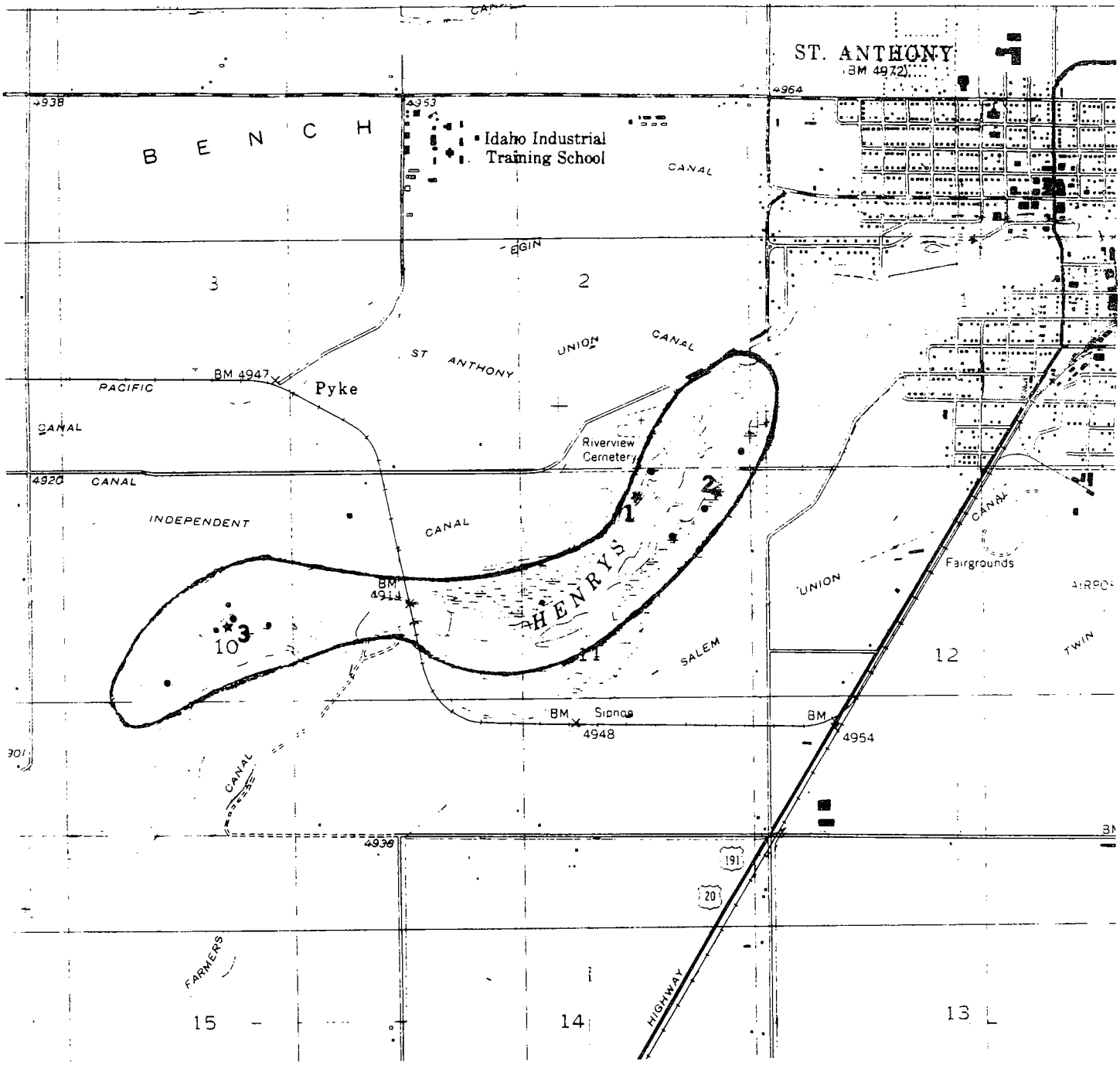

Figure 5. Known key use area within the St. Anthony bald eagle breeding area, Henry's Fork Snake River. Intensive monitoring has not occurred at this breeding area, and the information portrayed is preliminary only. The red line encloses the Principal Management Area. Numbers indicate known nest sites, numbered chronologically.

Raptor presence and habitat use.

In 1994 and 1995, we recorded presence/absence surveys in 437 randomly selected sample quadrats, with at least one raptor detected in 179 sample quadrats, and no birds seen in 258 sample quadrats (Appendix Table 2). We searched for 26 raptor species, and detected 17 raptor species within our sample areas. We have detected at least 3 more species in the area, but these species were not detected in sample areas in these sample years. Table 8 summarizes the raptor occurrences by general vegetative cover type.

Table 8. Summary of raptor observations (occurrence) by general vegetation type within the Snake River Study Area, 1994-1995.

Raptor Species	Macro Habitat (numbers refer to general vegetative cover type after Ulliman et al. 1991)										
	211	212	321	322	412	421	422	511	621	623	741
Ha.le.	2	2	2	0	0	7	0	3	0	46	1
Aq.ch.	0	0	6	0	0	0	0	0	0	0	1
Pa.ha.	0	0	0	0	0	1	0	0	0	2	0
Ac.ge.	0	0	0	0	0	1	0	0	0	0	0
Ac.co.	0	0	0	0	0	2	0	0	0	0	0
Ac.st.	0	0	0	0	0	1	0	0	0	0	0
Bu.ja.	2	0	8	0	3	7	0	0	0	16	0
Bu.sw.	2	0	0	0	0	1	0	0	0	5	0
Bu.re.	0	0	0	0	0	0	0	0	0	0	0
Ci.cy.	0	0	3	0	0	0	0	0	1	0	0
Fa.pe.	0	0	0	0	0	1	0	0	0	0	1
Fa.me.	0	0	1	0	0	0	0	0	0	0	0
Fa.co.	0	0	0	0	0	0	0	0	0	0	0
Fa.sp.	1	0	4	1	3	2	1	0	0	10	0
Ca.au.	1	0	2	0	0	0	0	0	0	1	1
Ae.ac.	0	0	0	0	2	4	0	0	0	0	0
Ot. fl.	0	0	0	0	0	4	0	0	0	0	0
As. ot.	0	0	0	0	0	2	0	0	0	0	0
Bu. vi.	0	0	0	0	1	6	0	0	0	5	0
% Area	35.14	2.12	18.31	1.36	9.44	8.19	3.14	4.62	0.87	6.92	0.53

We briefly discuss the sightings of each individual raptor species. Bald eagles were detected in 63 sample quadrats. Of this total, 46 were in cottonwood habitats, 2 over sagebrush, 3 over river, 7 in Douglas-fir, 2 over plowed fields, 2 over permanent pasture, and 1 in cliffs. Golden eagles were represented in 7 records, 5 over sagebrush-bitterbrush habitats, 1 over an upland grassland, and 1 over a cliff. Osprey were seen in 3 samples, 2 over cottonwoods and 1 in Douglas fir.

Among the accipiter hawks, we detected only 4 records, 1 goshawk, 2 of Cooper's hawk, and 1 sharp-shinned hawk. All of the observations were in Douglas fir. However, nest sites for goshawk and Cooper's hawk are known in cottonwood and aspen habitats within the study area, but outside the randomly selected quadrats.

Buteo hawks were relatively common. We detected nesting by red-tailed hawks and Swainson's hawks in cottonwood, aspen and Douglas fir habitats. Red-tailed hawks occurred in 36 quadrats, with 16 of these in cottonwoods, 8 over sagebrush, 7 in Douglas fir forest, 3 in aspen, and 2 over plowed fields.

Swainson's hawks were seen in 8 quadrats: 5 in cottonwoods, 2 over plowed fields, and 1 in Douglas fir. We did not observe ferruginous hawks in the study area.

We did note 4 records of harrier, or marsh hawks: 3 in sagebrush, 1 over willow. Outside of selected quadrats, we have detected nesting marsh hawks in CRP seeded grasslands on the river rim on three occasions.

Falcons were represented in 25 records. Peregrine falcons were detected in 2 records: 1 in Douglas fir (perch), 1 in cliffs. One of two known peregrine aeries within the study area fell within a sample quadrat. Prairie falcons were detected in only 1 record, over sagebrush. Outside of sample quadrats, we are aware of 3 prairie falcon aeries within the study area. We did not see any merlins in our observations in 1994-1995, although we have seen merlins in the study area on two earlier occasions. Kestrels occurred in 22 quadrats, 10 in cottonwoods, 4 over sagebrush, 3 in aspen, 2 in Douglas fir, 1 in juniper, 1 over plowed field, 1 in mountain mahogany. Kestrels were known to be nesting in cottonwoods and aspen.

Turkey vultures were detected in 5 quadrats, 2 over sagebrush, 1 over cliffs, 1 over plowed field, 1 in cottonwoods. These birds were seen soaring over a variety of habitats. We did not detect any nest sites.

Among the small owls, the northern saw-whet was most commonly detected. This species was heard singing in 6 records, 2 in aspen, and 4 in Douglas fir. We detected no northern pigmy owls in our samples, although we have seen and heard pigmys in Douglas fir habitats within the study area but outside our samples. Similarly, we did not detect any western screech owls despite many searches in sample areas, but have heard these owls in cottonwood habitats near Heise in earlier years. We did record 4 records of singing, and presumably nesting, flammulated owls, all in Douglas fir samples that featured mixed aspen.

Among the larger owls, great horned owls were relatively common and cosmopolitan in vegetative cover type. We noted 12 records, 1 in aspen, 6 in Douglas fir, and 5 in cottonwood. Known nest sites occur in cottonwood and Douglas fir habitats._Long-eared owls were noted in 2 records, both in Douglas fir, adjacent to sage stands. We also heard long-eared owls in cottonwood forests, but outside of sample quadrats. Fledged broods were seen on several occasions in Douglas fir and cottonwood forests. Short-eared owls were not detected in our samples, although we believe that they occur in open areas in the lower reaches of the study area.

We did not detect any great gray, barred, boreal, or burrowing owls in our study area. Great gray and boreal owls are known to occur near the area, but at higher elevations.

Macro habitat selectivity.

Eight species were seen frequently enough to allow analysis of macro-habitat selectivity in a contingency table (Appendix Table 3). All of these 8 species were significantly selective in their macro-habitat preferences (chi-square goodness of fit, p values <.001). Cottonwood, Douglas fir, and sageland habitats were used far more than expected under random association. Tilled cropland was the primary vegetative cover type in more selected samples than any other cover type (129 = 30% of samples, tilled cropland = 35% of total area), but represented only 4% of samples where raptors were detected. Two sagebrush dominated sample quadrats featured the greatest diversity of detected species, one with 4 species and another with 5 species. Raptors detected in sagelands were, for the most part, seen flying over the area and were assumed to be hunting rather than nesting.

Table 9. Contingency table for analysis of raptor occurrence by macrohabitat type, Snake River Study Area, 1994-1995.

		Macro Habitat Observed and Expected Values									
Raptor	Obs.	O	E	O	E	O	E	O	E	O	E
Species	n	211	211	212	212	321	321	322	322	412	412
Ha.le.	63	2.00	22.11	2.00	1.34	2.00	11.53	0.00	0.31	0.00	2.17
Aq.ch.	7	0.00	2.46	0.00	0.15	6.00	1.28	0.00	0.09	0.00	0.66
Bu.ja.	36	2.00	12.65	0.00	0.76	8.00	6.59	0.00	0.49	3.00	3.40
Bu.sw.	8	2.00	2.81	0.00	0.17	0.00	1.46	0.00	0.11	0.00	0.76
Fa.sp.	22	1.00	7.73	0.00	0.47	4.00	4.03	1.00	0.30	3.00	2.08
Ca.au.	5	1.00	1.76	0.00	0.11	2.00	0.92	0.00	0.07	0.00	0.47
Ae.ac.	6	0.00	2.11	0.00	0.13	0.00	1.10	0.00	0.08	2.00	0.57
Bu. vi.	12	0.00	4.22	0.00	0.25	0.00	2.20	0.00	0.16	1.00	1.13
% Area		35.14		2.12		18.31		1.36		9.44	

Raptor	O	E	O	E	O	E	O	E	O	E	O	E	Sum of	
Species	421	421	422	422	511	511	621	621	623	623	741	741	Chi Square	p-value
Ha.le.	7.00	1.88	0.00	1.98	3.00	2.91	0.00	0.55	46.00	4.36	1.00	0.33	444.49	0.0000
Aq.ch.	0.00	0.57	0.00	0.22	0.00	0.32	0.00	0.06	0.00	0.48	1.00	0.04	45.46	0.0000
Bu.ja.	7.00	2.95	0.00	1.13	0.00	1.66	0.00	0.31	16.00	2.49	0.00	0.19	92.72	0.0000
Bu.sw.	1.00	0.66	0.00	0.25	0.00	0.37	0.00	0.07	5.00	0.55	0.00	0.04	39.64	0.0000
Fa.sp.	2.00	1.80	1.00	0.69	0.00	1.02	0.00	0.19	10.00	1.52	0.00	0.12	57.17	0.0000
Ca.au.	0.00	0.41	0.00	0.16	0.00	0.23	0.00	0.04	1.00	0.35	1.00	0.03	35.66	0.0001
Ae.ac.	4.00	0.49	0.00	0.19	0.00	0.28	0.00	0.05	0.00	0.42	0.00	0.03	33.12	0.0003
Bu. vi.	6.00	0.98	0.00	0.38	0.00	0.55	0.00	0.10	5.00	0.83	0.00	0.06	54.60	0.0000
% Area	8.19		3.14		4.62		0.87		6.92		0.53			

Raptor nesting observations.

Our emphasis for the first two years of the raptor inventory has been presence/absence surveys. We have not begun structured nest searches nor attempted to monitor productivity, with the exception of the bald eagle work, a separate, specific objective.

Our incidental nest observations include: Red-tailed hawks in cottonwood and Douglas fir habitats, Swainson's hawks in cottonwoods, Goshawks in aspen and Douglas fir, Cooper's hawk in cottonwood, numerous Kestrels in cottonwoods and aspen, Long-eared owls in Douglas fir forests in Blacks and Dry Canyons, Great-horned owls in cottonwoods at four locations, 1 young in a cliff site at the confluence, and fledged broods in Douglas-fir in upper river areas; Flammulated owls in a mix of Douglas fir and aspen.

Garner et al. (1995) reported six raptor nests in the Snake River Study area: 1 Sharp-shinned hawk, 1 Cooper's Hawk, 3 Kestrels, and 1 Long-eared Owl, all in cottonwood riparian forest habitats.

Raptor Habitats and Land Use Activities: Effects and Management Recommendations

Although most of the habitats used by birds of prey in the western United States have been altered by land use activities, little quantifiable information has been collected on the effects, particularly long term effects, of human activities and habitat modification. It is difficult to accurately measure the cause and effect relationships of cumulative actions under field conditions, and isolation of a single factor requires control of many variables. With recognition that vast resources are needed to gather and rigorously test data on activity impacts and to monitor the effects of management actions, we provide the following synthesis of published information, with associated management recommendations.

Two important sources we used are - *Ecology and Management of Neotropical migratory birds* edited by T. E. Martin and D. M. Finch and *Proceedings from the western raptor management symposium and workshop* published in 1989 and made available by the National Wildlife Federation. Our summary presents information on potential, negative effects that we believe are relevant to the South Fork of the Snake River study area. Information is grouped by management activities and not by raptorial species. We believe this format is best suited to eliminate redundancy. Humans affect raptors by modifying (may be positive or negative) habitat, disrupting their normal behavior and by causing direct mortality of eggs, young or adults by such means as poisoning, shooting and electrocution. Habitat modification may be viewed as a two edged sword: whereas some species are negatively impacted by a set of changes, others may benefit.

Domestic Livestock Grazing

Modification and loss of vegetation affecting raptor nesting, foraging or security habitats. The Snake River study area features a relatively wide riparian cottonwood corridor within a large expanse of shrub steppe and agriculturally modified habitat. Unlike the grasslands of North America, western shrub steppe habitat in the Intermountain West did not co-evolve under the influence of large herds of grazing animals. Shrub steppe plant communities are not thought to be adapted to withstand continuous, severe grazing pressures. Intensive grazing of livestock can reduce overall plant species composition, structure and diversity, decrease site moisture and increase soil compaction. Domestic livestock grazing has also played a role in the introduction of exotic plants and subsequent reduction of forb cover (Saab et al. 1995). Extensive plantings of crested wheatgrass, which was introduced as livestock forage throughout the western United States, has resulted in reduced diversity and density of raptors through the reduction of their prey (Sharp 1986). Overgrazing, along with drought and fire suppression, are identified as major causes of the loss of native grasses (perennial and native seral species) and consequent increases in shrub and tree (juniper) cover, specifically sagebrush in the Intermountain West (Littlefield et al. 1984; Woodbridge 1991). This increase in shrubs comes about as palatable herbaceous plants are selectively removed by grazing animals and less palatable, shrubby plants are thus given an advantage. It is primarily through these habitat related changes that birds of prey are affected (Woodbridge 1986).

Domestic livestock grazing in riparian areas affects the composition and structure of vegetation as mentioned above. Intensive grazing can actually reduce or eliminate riparian areas through channel widening and lowering of water tables (Platts 1991). Many believe that

the fragmented and limited distribution of riparian habitat in the west makes them and the species that inhabit them particularly vulnerable to impacts such as grazing (Terborgh 1989).

There is little information about domestic livestock grazing in coniferous forest (Saab et al. 1995). One clear effect is the loss of savanna-like forest. Grazing along with fire suppression has eliminated low intensity, under story fires that once were of significant influence on forests in the western United States. Some believe that grazing has resulted in increased tree density, reduction of herbaceous and shrubby under stories and expansion of conifer trees into surrounding meadow, grassland, shrub and aspen habitats.

Most species experience long term negative effects from overgrazing. Effects depend upon the type, intensity, timing and location of grazing in the context of the individual raptor species. This is particularly true in riparian habitats.

Loss of native grasses within shrub steppe habitats is particularly detrimental to species that are ecologically linked to grassland habitats such as ferruginous hawks (*Buteo regalis*), northern harriers (*Circus cyaneus*), prairie falcons (*Falco mexicanus*), Swainson's hawk (*Buteo swainsoni*) and golden eagle (*Aquila chrysaetos*). The decline of Swainson's hawk in northern California and eastern Oregon can be attributed to this change from grassland to sagebrush communities (Littlefield et al. 1984, Sharp 1986, and Woodbridge 1991).

Ground nesting birds such as northern harriers can be directly impacted through trampling. Eggs and young birds, either ground nesting or those that have left the nest but remain on the ground, are vulnerable to increased predation as nest cover is reduced. Intensive grazing that changes plant composition and vegetation height and density can also result in changes to the small mammal and bird communities and their availability as prey (Feldhamer 1979, McGee 1982). Increases in shrub cover at the expense of herbaceous cover are favorable to production of jackrabbits, a primary prey for golden eagles and ferruginous hawks in some areas. However, ferruginous hawks have also shown negative responses to intensive grazing which reduced herbaceous cover and changed prey abundance (Kochert 1989, Woffinden and Murphy 1989). Again, this alludes to the specificity of grazing effects to specific areas and species. The effects of heavy grazing appear most tolerated by birds and small mammals that are granivorous and less tolerated by those that rely on a diversity of perennial forbs and grasses for food and cover (Kochert 1989). A good example of this shift under heavy grazing is the reduction of *Microtus spp.* (voles), a species active during the daytime and an increase in *Peromyscus spp.* (deer mice) a species active during the nighttime. The shift from one species to another is not always clear and predictable, because associations between small mammal population density and habitat condition are dynamic through time and space (Synder and Best 1988). An important point here is that grazing can directly affect birds of prey through changes in their prey base. This is particularly important for those raptors that have narrow food niches.

Long term modification of vegetation composition and structure.. Of particular concern is the loss of trees and shrubs used for nesting due to intensive grazing pressure. Small stands of trees that are solitary or isolated by surrounding open areas may receive high livestock use for shading, rubbing and forage. These same stands are equally important to tree and cavity nesting raptors such as kestrels (*Falco sparverius*), saw-whet owls (*Aegolius acadicus*), red-tailed (*Buteo jamaicensus*) and Swainson's hawks (*Buteo swainsoni*). Some of the aspen stands on the benches above the South Fork of the Snake River, which are inhabited by northern goshawk

(*Accipiter gentilis)* and kestrels, are an example of this situation. Abrasion, herbivory and trampling concentrated in small aspen stands can cause the death of nesting trees and eliminate young regeneration that provides future nesting habitat (Olendorff and Stoddart 1974). Early season grazing followed by removal of livestock allowing for plant regrowth appears to be a preferred system of use in riparian areas, as is late fall and winter grazing. Studies which address season of livestock grazing in cottonwood areas show variable results in the resilience of shrubs and cottonwood seedlings. Authors warn that these studies may be too short term to draw conclusions (Glinski 1977, Sedgwick and Knopf 1991).

Sources of direct mortality - trampling, shooting, trapping and poisoning. Trampling of eggs or young, flightless birds may occur with ground nesting species such as northern harriers and short-eared owls. Persecuted as predators, shooting of raptors has occurred throughout the United States and has probably had significant effects on individual populations. Loss of birds of prey as a secondary target to trapping still occurs, but is less of an impact than in the past when trapping was more generally targeted for scavenging animals, such as bears and coyotes, without consideration to non-target species. Another cause of secondary loss is from insecticides used on livestock such as Warbex. This oraganophosphate insecticide, which is poured onto livestock to control grubs, has toxic ingredients which persist for 90 days unabsorbed and have become available and fatal to raptors (USFWS 1986).

Conclusions and Management Recommendations. The most meaningful management recommendation is to follow the Bureau of Land Management's internal direction to maintain properly functioning grassland, riparian and rangeland habitats (BLM 1994). Focus upon the functional health of an ecological area or habitat will meet the needs of individual plants and animals evolved within that zone, and avoids the possibility of managing for one species at the cost of another. Use of domestic livestock as a vegetation management tool is encouraged, rather than grazing solely for production of red meat and wool. Solutions to overgrazing are best addressed on an area specific basis. Solutions may include reduction in numbers of grazing animals, change in season of use, or elimination of grazing from certain areas. Careful monitoring of implemented management strategies is needed to determine grazing impacts.

Despite a lack of overall information on grazing effects, a thorough literature review by Saab et al. (1995) revealed that birds which inhabit lower levels of vegetative structure consistently declined in grazed habitats. Northern harriers and short-eared owls (*Athene cunicularia)*, both found within the Snake River study area, fall in this category.

The recently published Northern goshawk management recommendations for the Southwestern United States recommend that livestock grazing not exceed 40% of grasses and forbs and 60% for shrubs. These utilization standards are recommended as a way to protect goshawk habitats and principle prey species. Preferred goshawk habitats are found in and around late seral forests.

At this time there is no clear evidence that domestic livestock grazing is affecting the recruitment of cottonwood trees along the South Fork of the Snake River, Idaho (M. Merigliano, pers. comm.). These trees provide important nesting habitat for raptors. It is suggested that following years of good cottonwood recruitment, measures should be taken to keep domestic livestock out of areas where young shoots occur. Some authors have suggested that small groves of trees and shrubs used for nesting be fenced out of a grazed pasture to